CHIST-ERA Call Development Conference 2021 - Topic 1 - NOEM for ICT #4

Practice area

Click and drag the post it to move it

Practice adding notes to the MURAL board here

Double click to produce a post it note and type on it

Hi

Hello

Hello

Drop the post it note here

qwerty

test 1

Hello

Double click tag to type your name and affiliation, drag to your location on the map

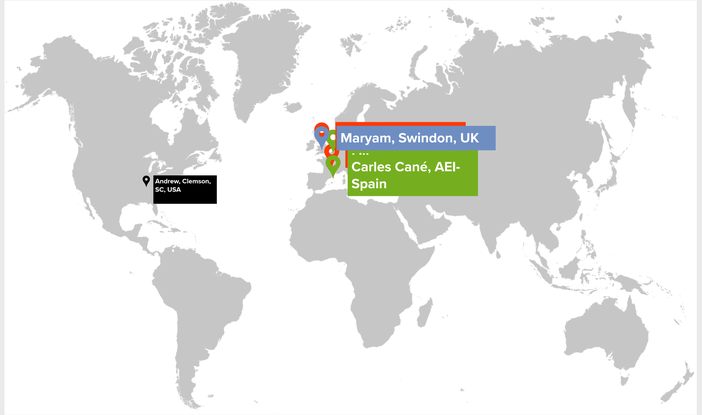
Tag your name and affiliation

Name, Location

Name, Location

Name, Location

Name, Location



Free Parking

Zoom in and add post it notes

This space is for any ideas you may have that there is no place for, or any feedback you would like to give the organisers

Session I

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Brainstorming

Well Sorted Outputs

sensitivity

size

Silicon is the mainstream technology for electronics and MEMS, and is becoming the main technology for photonic integrated circuits. Therefore, it would be desirable that NOEMS are compatible with silicon technology (in particular, CMOS).

Zoom in and double click to produce a post it note

used in digital manufactuting, environmental monitoring, health monitoring

NOEMS transforming eye tracking technology, moving away from video-based systems

Low-power, day-long eye tracking

merging optical with NEMs, all parts can be exploiting, optical high speed sensing

Low complexity, low cost, low power consumption transceivers for sub-6GHz and mmwave bands

Demonstration of component based on physic at the soa MZ, TI, filters, unidirectionality

Many electromechanical and optomechanical systems operate in cryogenic environments, which strongly limits its use in many applications. Operation at room temperature would ensure massive use in multiple applications.

Numerical simulations FEM, FDTD

IoT etc.

eye glasses communication into an IoT network

Which NOEMS are best applied for capturing human gaze behavior

Long term benefits

Resources and Skills

Methodologies

NOEMS for ICT

Silicon fabrication can be used, translated from Si photonics

Existing NOEMS current capabilities and applications/use cases?

Mass sensing

Which NOEMS are best placed for integration into radio transceivers - e.g. mixers, BPFs, optical modulators.

Joint RF and optical skills are in very short supply

Camera-free mobile eye tracking is an emerging technology

focussed ion beam, lithography

Mixed-signal circuits with analogue and digital parts - what are the best architectures to achieved software-defined radio.

Gaps

Devices that operate at >30 GHz

low power, high range bandwidth, comms

Experimental testbeds support realistic data sets and are essential to skills development

Identification of scenarios where gaze can be captured over long periods, e.g., pilots, ATC people

more advanced fabrication technologies, limits in fabrication

NOEMS applied to high-speed eye tracking (> 300 Hz)

Gaze-sensing glasses communicating with other IOT devices

scaling up production

Modelling at the nanoscale

Operation in many different mechanical frequencies is high desirable, in particular, if we look for application in data processing or wireless systems where operation many bands in the GHz regime would be desirable.

wireless network, 5-7G, optical processing, aircraft comms

miniaturisation

arrays of oscillator, can be used in neural computing architecture, resulting in lower power (with optics)

packaging - issues around optics

DSP and sensors (electrical, optical and mechanical)

modelling - issues with meshing due to nanoscale, non linear, quantum physics, contact and sticking, can do without contact

NOEM based gyroscope

Explore the Stregnths, Weaknesses, Opportunities and Threats for the Overarching Themes from the previous session

Overarching Themes

Overarching Theme

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From the points made in Part 1, list the overarching themes that can be identified

1. Camera-free eye tracking
2. Full monolithic integration (CMOS)
3. Application to RF technologies
4. Application to Sensing technologies
5. RF and Optical Skills
6. Tools - Testbeds/demonstrators/Simulators
7. Low power, long term use
8. Multmode capabilities e.g. for comms, sensing, etc..
9. Multi-physics (electical, acoustic, optical, heat, opto-mechanic ...)

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Session II

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Ranking Overarching Themes

From the points made in Session I, rank and add a description to the Theme

1. Application to communication technologies
- developing RF and optical skills
- demonstration of physical properties of components, topologic insulator, filtering, guiding, demulteplexing,...
- integration and communication of components
- Acoustic and optic metamaterials
- integration

2. Application to sensing technologies
- low-power, opto-mechanical systems to act as sensor devices
- to be used in scenarios where human behavior is measured, e.g., eye tracking
- with possible communication to other IOT devices
- determination of fluids properties, mass,
- integration

3. Multimodal and multi-physical capabilities
- electrical, acoustic, optical, heat, opto-mechanical, etc.
- low-power, long-term use
- room temperature
- neuromorphic computing

4. Modeling at the nanoscale
- van der Waals forces have a greater effect
- experimental test beds to support modelling

SWOT Analysis

Zoom in and add post it notes

Overarching Theme #1

Strength: miniaturisation of the device size; Integration - circuits and NOEMS on a single device; frequency agility - tunability, reconfigurability; Can the mechanical resonance be tuned with the higher frequency bands; Non-silicon has compatibility issues; Dynamic control of information, reconfigurable modulators from optomechanic; high speed on-chip devices

Weakness

Opportunity: 6G will provide a strong pull; Broad range of devices and applications, for example: 5G applications, Mac, aerobics, intern, IoT, Energy efficient chip, sensors, measurement, etc; e-Health; IoT, Energy efficient chip; environmental monitoring; Digital Manufacturing and data driven processes; Human Machine Collaboration; aquaponic farming

Threat: Joint RF and Optical skills are in very short supply

Overarching Theme

Strength: Low power; High sampling rates (> 300 Hz); NOEMS implemented in silicon offers a mass manufacturing at cost capability; High endurance (e.g., day-long duration); Multiple applications & use-case scenarios; Is nano-scale feasible and does it make sense for sensing applications; sensing accuracy would need to be measured

Weakness

Opportunity: Human-machine systems; Transformative technology (e.g., moving away from camera sensors); Work considering the quantum limit is understood and how this translates to real world ATT uses; Multiple applications; Integration with processing chips/signal analysis; multifunctional sensing applied to tunable optical metasurfaces; multifunctional sensing applied to IoT, Energy efficient e.g. manufacturing, healthcare, Transport

Threat: possible electro-magnetic interference "in the wild", e.g., IR light

Overarching Theme #3

Strength: Gather different excitation on a same platform; Wireless interface; Room T and ambiant pressure; Optical connection with optical fiber; data fusion; Mode conversion; Losses impact; Long-term durability; Complexity (operation, fabrication)

Weakness

Opportunity: Joint sensing and communication; Body sensors; Application in ICT verticals; Demonstrate new physical properties/ capabilities; Neuromorphic computing/ Physical computing

Threat: electromechanical energy conversion efficiency; Fine tunability of the mechanical resonance

Overarching Theme #4

Strength: component at the sub wavelength size; Reconfigurability - devices and circuits; tools not available, multi physics and time consuming; Effect of short range force (van der Waals) should be taken into account in modelling

Weakness

Opportunity: Acoustic Metamerials; Reaching the frequency of 10 GHz by extreme miniaturization (plasmonics); Validate models with measured characteristics in an applications context.

Threat: High cost of experimental testbeds to characterise performance; Availability of NOEMS devices; What is the performance consistency between batches?

Session III

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Maximising Success.....

How can Weaknesses and Threats be addressed

Refer back to the SWOT analysis and discuss how the weaknesses and threats could be mitigated

What is deliverable in a 2-3 year project

What could a CHIST-ERA Project potentially deliver?

Transnational difficulties

What challenges could be faced by a BCI CHIST-ERA project due to its transnational nature